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ABSTRACT

Written as a guide for outdoor education, this teacher's manual outlines the use of the nature-resource center in Nashville, Tennessee, as a resource for curriculum enrichment. The first part of the manual provides general information for basic understanding of the center. Included in this part of the manual are an introduction to the center, things to see on the way to the center, ideas cn classroom objectives prior to visiting the center, some suggested follow-up activities in the classroom, and some ground rules to be followed when visiting the center. The second part of the manual discusses each trail that may be taken and provides an explanation of what is to be seen at each station on the particular trail. Concepts to be developed at the various trail stations are enumerated, and field notes for lessons on such things as animals, forestry, geology, and plants are provided. (DB)

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OUTDOOR EDUCATION

MANUAL FOR THE NATURE-RESOURCE CENTER

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[1967]

METROPOLITAN NASHVILLE-DAVIDSON COUNTY SCHOOLS

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The Outdoor Education Nature-Resource Center

Teacher's Manual

Introduction

This guide has been written to help you, the teacher, provide for your students a more enriching educational experience at the Outdoor Education Nature Center. We would encourage you to first read this manual and then spend some time planning your desired activities and experiences. We hope that the Nature Center will provide you with most of the experiences you want. After you have scheduled the trail you wish to visit, additional material with grade level questions, discussions, and suggestions, will be sent to you.

Each page on this guide represents a single station on a trail. For each station there are a number of concepts and notes designed to give you, in advance, some generalizations that can be discussed and illustrated, and some information that will support these concepts. The notes in the manual should not be read to the students. The additional material sent to you and that which will be given you at the center is on grade level and for use with the children. The manual should be interpreted by you, as the teacher, at whatever level is required and used as pre discussion and follow up back in the classroom.

The concepts and notes listed here are by no means the only one to be found at each station. They are simply some we think that can be considered at the point. You may have some better, more applicable one in mind which will better meet the needs of your individual class (we would appreicate any suggestions from you).

Each trail has one main theme but the concept of Ecology and the interrelationship of plants, animals, and man will be stressed on all trails. Some concepts may be repeated at several stations and can be used to reinforce the important ideas.

Some plants and trees will be marked and there are information signs on each trail. Where a question is asked on

a sign or in the graded material, a color key will be sent to you from the center. A reference will be made to them in the manual but not the actual direction. Copies of any questions to be answered on site, by the children, will be sent with the other material. An attempt has been made, at the center, to clear an area around each station so the class can group together for discussions. The signs can be read as a group travels along the trail.

The exhibit house is for the children to see some concepts that will be presented on the trail. New exhibits will be put up from time to time. The exhibits are centered around what might be seen on the trail and ideas that can be used for exhibits back in the classroom.

We would hope that in addition to the material that will be presented to the children prior to their visit some discussion will be held in regard to manners in the woods, not taking any thing unless it is provided as part of the experience (seeds, insects, etc.) and not throwing things on the trail. Since there are so many children using the center, care must be taken to replace rocks turned over, and to attempt to keep the area as natural as possible.

Since many of the children using the center have never been to the woods, indeed, never crossed over a river on a bridge, we are including in the front of the manual some things you may see along the way. This can be used in any way you wish. Some groups have had committees to see the number of businesses there are, types, etc.; some to see the number of animals; some to watch for points of interest mentioned in the guide. There are several things along the way such as fire towers, bee hives, etc. Help point out concepts to be learned.

The area is a natural one, and the children and teacher should come dressed as if for a "hike".

The Nature Center is for your use. We hope you will give us suggestions and ideas that will better help you to teach some concepts through Outdoor Education.

Because many of the activities at the center are the same as used by the Outdoor Education Consultant on school site, it is suggested that you not book both the Consultant and the Center for the same curriculum subject.

ON THE WAY TO THE CENTER

From past experience we have found that many of the children have not traveled very far from their own neighborhood. In order for the trip to the center to be as meaningful as possible there are some items along the way there that can be used to teach different concepts and ideas.

Since most schools will come out by way of 18th Avenue onto the Clarksville Highway, the following information on things to see on the way to the center is given from Charlotte Pike to the entrance:

At the corner of Charlotte and 18th is Fisk University, built right after the war between the states and financed in the beginning with funds raised by the Fisk Jubilee Choir who traveled all over the world.

On down 18th can be seen part of Highway I 40 being built. Farther down can be seen Wharton School, one of the few K-12 schools left in Metro.

On the left before the bridge can be seen land that is being "filled". Questions might be asked such as "Why is land being filled here?" (to bring it level with highway), and "Where does the fill come from?" (places where dirt and rock have to be taken out for buildings)

On the right can be seen a golf course with well-kept greens. The bridge is built over the Cumberland River. On the left of the bridge up the river can be seen a small power plant. On the left side of the bridge large pipes carry natural gas.

Cumberland High School is on the left. Over the hill can be seen a green house on the left. This might bring up questions: "Where do the florist get their flowers?" (in the green house and the field outside is planted in the summer for blooms)

The large hill on the left has been partly cleared. This could bring troubles as the undergrowth washes off. Without trees to hold the water, gullies could occur and the top soil could be washed away. The question is: "Why did they clear off the hillside?" (There does not seem to be a reasonable answer for this unless they plan to build houses on the side of the hill and so far nothing has been done. It would be difficult to farm the steep hillside.)

On the right can be seen a wooded area. Usually there are some horses and ponies in a corral. There are salt blocks in the area. "What could those white blocks be and why are they put there?" (Animals need salt just as we do and the owner must put out some for his animals.)

On the way to the center continued:

Just beyond the horses will be a fruit orchard. Behind them on the edge of the lake is a row of bee hives. "Why would the orchard owner keep bees?" (to be sure his orchard was pollenized)

The hills in the distance will show many colors, not only in the fall but all year. Because of the distance away this can be noticed.

Farther on there will be a large power station on the right. Usually there will be cattle in the field on the left. Some farming can be seen close to the highway.

As the bus goes up Germantown Hill, interesting rock formations can be seen on the cliff side. The layers of rock show bedding.

Over the hill there is a fire tower on the right. Just before the turnoff can be seen a cornfield.

Along the road to the center will be seen horses, and some cows in the field, as well as some farming being done.

These sights can be used to help the children enjoy the trip or to teach them some rural living facts. For those buses going through town you may want to stress types of stores or buildings on the trip.

FORMULATING CLASSROOM OBJECTIVES AND PLANNING ACTIVITIES

The teacher should plan and discuss with the class the activities to be covered at the outdoor school well in advance of the trip. The more work done prior to the outdoor experience, the more value will be derived from the trip itself. For instance, if time is spent in the classroom in the study of the characteristics of amphibians, their physical make-up and economic importance to man, more time can be spent outdoors in locating the habitats of specific species of amphibians, identifying the, and observing their influence upon the natural environment. The outdoor center, therefore, should serve as a living, outdoor laboratory where observations and studies can take place and where solutions can be found to problems concerning a particular unit of study discussed in the classroom.

FOLLOW-UP IN THE CLASSROOM

It is recommended that the classroom teacher and the class evalutate the program after returning from their visit to the center. What positive gains were made? Were all of the objectives met which the class developed? If not, why? In what areas could planning have been better? And so on.

Further in-depth "research" projects which were started at the outdoor school should be continued in the classroom. For example, an intensive study might be made of the Indians and early settlers who lived in the area. New teaching units may be developed, such as how the geological characteristics of a country affects its history. Exhibits and displays may be set up in class as a result of the trip, and perhaps a class play written about the children's experiences at the center, which might be presented to another class or at a school assembly.

Both pre-planning and follow-up are extremely important if the visit to the outdoor center is to be a truly valuable and meaningful experience.

GENERAL SUGGESTIONS

Group Control

1. In order to avoid discipline problems while at the outdoor nature center, the classroom teacher should impress upon the children that coming to the outdoor school is merely an extension of the school program into an outdoor setting. The field trip should not be considered a school holiday. Although we hope that the children will have an enjoyable time, the pupose of the trip is not to provide entertainment.

2. Talk about group behavior in an outdoor setting and encourage the children to participate in the discussion. Ask them what rules of conduct are important, when making a trip such as this, which will be of benefit to the whole class and to each individual, in terms of learning, enjoyment, and personal safety. The teacher might use the term "Woods Etiquette". Guide the children in developing their own rules; they are more apt to follow them than if they are <u>told</u> the rules by which they must abide.

   a. Discuss proper rules of conduct on the bus, at lunch time if a meal is brought, and in the out-of doors.
   b. Discuss the importance of protecting our natural resources against malicious destruction.
   c. Follow the rules of the woods:
      (1) Stay with your group. Why?
      (2) No running on trails. Why?
      (3) Don't throw rocks or branches. Why?
      (4) Be quiet while on the trails. Why?
      (5) Avoid littering: help keep the woods clean and beautiful. "We are guests."
      (6) Wildflowers and other plants are for everyone to enjoy. <u>PLEASE DON'T PICK WILD FLOWERS OR ANY OTHER PLANTS!!</u> This is a center rule!

3. The classroom teacher is responsible for maintaining student discipline in his or her class while at the outdoor school. The teacher is also responsible for checking class attendance before boarding the bus in the morning, at lunch time, and before leaving the center in the afternoon.

5. Upon arrival at the outdoor school, do not allow children to walk away from the bus until directions have been given by the outdoor teacher.

ARRIVAL AT THE NATURE CENTER

Upon arrival at the nature center have the children proceed to the sheltered area. Here they will have a brief orientation period. Since the trails are self-guilding and contain various activities, each class will start at ten minute intervals. When there are two or more classes using the same trail the departure will be staggered. One class will go directly to the trail hile the other class views exhibits and weather station located at the center.

When on the trail the children are asked not to pick any flowers. Rocks that are turned over are to be replaced in their proper position. Nothing is to be taken from the center unless directed to do so in the material that pertains to your trail. It is suggested that the children stay in two's while walking and remain as quite as possible. At each station the area is cleared; here the children may gather around for participation. While going from station the children are asked to stay on the trail and not wander into the woods.

There are trash cans located at different places around the center. These have been placed here for the children who are staying for lunch It is hoped that the teacher will instruct the children about the importance of placing all paper and trash in these cans rather than leaving on the ground.

Enjoy your trip, explore nature, and become acquainted with its many mysteries.

ON THE TRAIL

The teacher should discuss the following suggestions with the class:

1. Wear clothes suitable to weather conditions.

2. Do not drink water from springs, ponds, or streams.

3. Do not attempt to catch or handle <u>any</u> animals without permission from the teacher. This includes frogs, toads, salamanders, and snakes. Special precautions must be taken with mammals, for they can carry rabies.

4. Become familiar with the appearance of poison ivy. Don't touch or allow clothing to come in contact with any plant with which you are unfamiliar.

5. Avoid tasting or eating leaves or berries with which you are unfamiliar.

6. Watch where you are walking; look in front and above you.

7. Don't run while in the woods.

8. Keep well behind the person in front of you, when walking on a trail, in order to avoid having a tree branch snap back in your face.

9. Keep away from the banks of any body of water and from any steep slope.

10. Never wander off by yourself.

11. Rocks should lie where they are; do not throw them. Someone might be seriously injured.

12. Wear comfortable and loose-fitting clothing. Girls should wear slacks. Good broken-in sturdy walking shoes are desirable. Discourage children from wearing leather-soled shoes or sneakers, especially smooth-soled sneakers, if possible.

NOTE: For the comfort of the teachers, it is suggested that they dress comfortably, keeping in mind that they will be accompanying their classes on field trips. It would be advisable for the women to wear slacks and flat heeled shoes.

ANIMAL TRAIL

Introduction

Animals are born, grow to maturity, and die. Animals live in a "home range" area. Animals are dependent upon food, water, and shelter in order to live and survive. Food, water, and shelter form the animals' habitat.

Some animals are tiny, some are medium size, and some are large. Animals such as the protozoans, worms, crayfish, insects, spiders, clams, and starfish have no backbones. They are called invertebrates. Others such as fish, frogs, snakes, birds, and mammals have backbones and are called vertebrates.

There are many different animals living in our nature center. Many of the smaller animals live in tunnels or burrows underground. Some live mostly in hollow logs, stumps, or in shrubs and trees above ground. It will be almost impossible for one to see many of these animals because of the noise and their fear of humans. We will devote our study to their habitat.

Some animals are useful to man, providing him with meat, leather, and furs. Others help to control destructive insects and small rodents. Mice, rats, chipmunks, and rabbits are important as food for larger mammals. Animals which eat other animals are called predators. Many of the mammals, including humans, are predators. Those which eat meat are called carnivores, and those which feed only on plants are called herbivores. Animals that eat both meat and plants are called imnivores. The live animals in their habitat cages will be discussed in the grade level material.

ANIMAL TRAIL

Station I

Concepts:

1. Animals cannot survive without a suitable environment. Food, water, and shelter are essential for their survival.

2. Certain animals will be found inhabiting specific places in a forest community.

Notes:

There are many different animals living in this area. These range from microscopic one-celled organisms, called protoza (amoeba, paramecum), to larger animals (rabbits, birds, and insects). Some of these animals will have backbones, and some will not. In this area animals will be found living above as well as below ground. The earthworm, a common animal, will be found living below ground. It is equipped with an exoskeleton which enables it to withstand the pressures of the earth which surrounds it. Moles and shrews are examples of other animals which burrow and live underground.

A suitable habitat will also be found for birds, rabbits, and other animals in this area. The short and tall grasses in this area provide them with shelter. The weeds, summac trees, persimmon trees, and wild grapes provide food for the animals.

ANIMAL TRAIL

Station II

Concepts:

1. Certain animals will be found inhabiting specfic places in a forest community.

2. The forest community is constantly changing.

3. Animals are important in the balance of nature.

Notes:

Approach this station quietly and be alert for animals. This is an area that is in the very early stages of succession, reversion back to the forest. The plants in this area, blackberry being one, will eventually be replaced by larger trees, oak, maple, and hickory. As time goes on the grasses will be shaded and die. As these changes take place the types of animals that use this area will also change. At this stage of of the forest, which is really a buffer zone between a field of grass and the forest, rabbits, woodchucks, deer, field mice, and quail search the area for tender grasses, insects, and seeds. Animal paths, droppings, mouse burrows, dense plants that have been eaten, and tracks will be evidence of animals inhabiting this area. Moles burrow through the soil searching for insects. Foxes, bobcats (maybe), and owls search that area at night in hopes of catching some animal. They help maintain a stable and healthy community by killing off the weaker animals.

ANIMAL TRAIL

Station III

Concepts:

1. Our forest provides a home for many types of wildlife.

2. Food in the forest can be found in many places.

Notes:

This area, because of the tall trees shading out the sun, has become almost void of shrubs and herbs. Some animals will no longer find it a suitable place to live, while others will find this area suitable for their habitat. Squirrels, woodpeckers, raccoons, and skunks will use it. The chipmunk is an animal that will inhabit this area. His food will be acorns and nuts from the trees. The skunk, a very bold and jealous animal, will also be found here. The fallen trees and tree stumps provide homes for insects and, therefore, food for the skunk and raccoon. The skunk and raccoon are nocturnal animals and are rarely seen in the daytime.

Plants also grow in this area and provide food for animals. The May apple is one plant that grows here. It develops a small oval shape fruit which is eatable and animals use it for food.

In the winter animals will burrow into the ground and sleep most of the winter. Their body respiration will slow down and their heart beat and pulse rate will become slower also. Snakes, woodchucks, earthworms, mice, and chipmunks are animals in this area that hibernate in the winter.

ANIMAL TRAIL

Station IV

Concepts:

1. Things grow, mature, reach old age, and die.

2. Nothing is wasted in the forest community.

Notes:

The litter on the forest floor provides homes for many small insects. Below the fallen tree leaves, which is called the humus layer of soil, insects are living. Some insects live above others in a highly developed community. The ant is an insect which lives in a developed community.

The fallen logs in the area are dead trees being reduced to humus (back to soil) by fungi, bacteria, insects, and other organisms. Fungi and bacteria are plants that do not have chlorophyll, therefore, cannot make their own food. The fallen log provides food and shelter for animals. Ant colonies will be found in some fallen logs in the forest.

Inside the log snails and slugs, centipedes, insects, and spiders can be found. Beetles are also found in fallen logs where they lay their eggs which hatch into larvae and eat further into the log. As the fallen log decays and becomes softer, different animals and insects move in. The salamanders are examples of animals inhabiting the log as it continues to decompose.

ANIMAL TRAIL

Station V

Concepts:

1. Animals live above ground.

Notes:

We are now in the climax forest area. Here we find our large oaks, hickories, maples, and beach trees. These trees provide homes and food for certain animals living in this part of the forest.

The squirrel is an animal found in this part of the forest, making its home in the tops of tall trees among their branches. In the winter the squirrel will make its home in the hollow of a tree. The fruits of the hickory, oak, maple, and walnut are collected by the squirrel and stored for winter food.

Deer may also be found in this area eating the acorns from the oak trees. The woodpecker is a bird that might be found in this area feeding on insects which have invaded the trees. The woodpecker is a helpful animal for the trees because it relieves the infected trees of the many insects found on or in them.

Wood Ducks are often found nesting in the tall trees near a stream or pond. The baby ducks have a special hook to enable them to hang on to the tree--when it is time for them to leave the nest the mother will push them off the limb. They will fall and literally "bounce" from the water. These are the only ducks who nest in trees.

ANIMAL TRAIL

Station VI

Concepts:

1. Animals can be found living in water and along stream banks.

Notes:

Frogs, turtles, fish, snakes, crayfish, and other aquatic creatures inhabit this part of the forest. Along the banks of this stream will be found rather large holes with small balls of dirt piled around them. These are holes made by a crayfish or some other animal. In the stream at various levels will be found other forms of animals and insect life.

This part of the forest also serves as a possible food source for animals located in other areas. The raccoons will often come to the stream in search of a meal of frog, fish, or insects. Life in this part of the forest will at times encompass all the animals in the forest because it furnishes one of the basic necessities of life, water.

The stream bank is also used for frogs and snakes which hibernate in the winter. They dig into the earth and there they remain during the winter months.

ANIMAL TRAIL

Station VII

Concepts:

1. Animals live in the crown of trees.

Notes:

Trees in the forest provide homes for many animals. Some live in the base, others along the trunk, and still others in the crown of the tree. Raccoons, gray squirrels, snakes, owls, and woodpeckers make their apartments in trees. The woodpecker will make a hole in a tree by pecking out the wood with their beaks. Owls will use a vacated hole left by a woodpecker to make his home.

Certain birds will be found nesting high in the top of trees. The squirrels' home can be seen high in the tops of trees. Their home is made mostly from leaves. These homes are so constructed that they will remain stable and secure during the most severe weather conditions. Be alert at this station for animal apartments located in the trees.

SIGNS OF FALL TRAIL

Station I

Concepts:

1. Many things live in the field that we cannot see.
2. All of these plants and animals are dependent on each other.
3. Man is also dependent on these plants and insects.
4. Some plants and animals do not stay in the same form in the winter.

Notes:

Activity: Single line of children side by side, walking through the field to the first marker.

Many small insects and other things will be disturbed by the walking. These make up a micro-community in this spot. These would be different at the fence row and in the woods. Each of these plants and animals require certain things that are found in this particular type of area. These same plants and animals may be found close to the fence or some may not be found anywhere except in this area.

Some of the interdependence of plants and animals can be shown here by the shelter provided for the small insects. At first glance nothing can be seen but when disturbed, many animals and insects will be seen. Food for these can be found in the area. By observing closely the types of insects and plants in the area, discussion can be made on which are helpful and harmful to man. Usually there are bees, and the importance of these insects should be made clear (bee hive in exhibit area). The short life span of insects can be discussed. On the trail children can watch for any caccoons or pupli that have been made.

Many seeds may be picked up along the way. Children will be provided with an envelope for this.

SIGNS OF FALL TRAIL

Station II

Concepts and Animals:

1. Man uses some seeds for food.

2. Different plants are found along a fence row.

3. Plants and their seeds cannot grow in the cold.

Notes:

The Summac tree has red berries on it. These are food for birds and animals. The Pioneers used to make pink lemonade from the berries. Some may be taken to the classroom to try this. Put berries in a cloth bag; place in boiling water; squeeze the juice from the bag; add sugar to the "pink lemonade".

Some seeds will sprout any time they are given water and warmth. Others must go through a resting stage, called dormancy, first. If all the seeds sprouted as soon as they fell to the ground in autumn, the young seedlings would be killed by the cold. Usually these seeds have hard tough seed coats, through which water cannot enter. The locust seeds are like this (see marked locust tree). Apple and peach seeds will not sprout at once either.

Many birds help to plant seeds, often by eating the entire fruit (cherry, hackberry), and having the seed come out as droppings. Since many birds will sit on fences, you will find plants such as cherry trees and hackberries along fence rows. At this area we have sassafras and sumac, both with this type of berry. These berries are providing food for birds and animals.

The travel of seeds and what will happen to them in winter can be discussed. There is a growing temperature

for each plant. The low temperatures in winter slow down the life process, such as plant growth or food making. Seeds, therefore, will remain in the ground until the ground is warm enough to start these processes again. Seeds are baby plants in a dormant state. Each has a quantity of food to supply the materials and energy it needs for sprouting. Because there is little water in a seed, it can be frozen without injury, and many seeds actually must be frozen before they will sprout. Annuals such as golden rod will die out except for the seeds which will be dormant until the spring. Biennials such as Queen Anne's lace and mullein grow a low lying group of leaves the first year, then a tall plant that bears flowers and seeds the next year. The excess food made during the first year is stored in a thick tap-root that gives the plant a start the next year. The second year the plant dies completely, leaving only the seeds to survive the winter. The above-ground parts of perennial such as iris, solomon seal, and narcissus die each year, but the underground parts remain alive. They send up new shoots each year; they also provide seeds each year.

SIGNS OF FALL TRAIL

Station III

Concepts:

1. All trees change in the fall.

2.. The fall color of leaves is there all of the time.

3. Buds on a twig will make new leaves.

Notes:

The two types of common trees, evergreen and deciduous, can be seen at this station. The evergreen can be seen at a distance; at another station closer observation can be made. Changes are taking place in both types, but it is more evident in the deciduous. As the tree becomes dormant for the winter there is no more need for food. A corky wall between the leaves and the twigs is formed and the wind can detach the leaves from the covering over them. These coverings protect more from evaporation than from freezing as water is at a premium. The yellow of the leaf has always been there. The green chlorophyll has covered it. Now that the leaf cannot get water the chlorophyll will die. Removing the chlorophyll will unmask the yellow. Grass that has been covered with a board will illustrate this. The red is a pigment that may be produced by chemical changes of minerals and sugar that has remained in the leaf. Where leaves have fallen from trees notice the scars left by the falling leaves. The bud can also be seen with its covering. It must not be inferred with the children that the trees consciously prepare for winter. They have simply become adapted to the difficulties of winter and the dropping of leaves is one of these adaptations.

SIGNS OF FALL

Station IV The Persimmon Tree

Concepts:

1. Trees provide food for man and animals.
2. Seeds must travel away from the "mother" tree in order to find food to grow.
3. Man and animals help these seeds to travel.

Notes:

The fruits of the persimmon tree are eaten by many wildlife. Droppings of the fox at the center have disclosed many of the seeds. If there is ripe fruit (on the ground), the children may eat it. Save the seeds, they can be used to make necklaces or when opened, the inside of a persimmon will show a shape that looks like either a "knife, fork, or plate". These fruits (which must be soft and dark orange to be ripe) are eaten by quail, raccoon, opossum, sknuk, wild deer, foxes, and wild turkeys-a wild type, often seen in stores is not usually found in this country. The wood of this tree is used in golf clubs, billiard cues, mallets, and some flooring as it is close grained and very hard.

If all of the seeds on this tree fell to the ground right below the tree, there would be no food for the seeds when they started to grow in the spring. They must be "carried away" from the trees in some manner in order that they might find a better place to grow. As with other seeds there are several ways to travel. By having a fruit that tastes good, this tree depends on animals and humans to carry its seeds away. An animal will eat the entire fruit. The seeds cannot be digested, so they will leave the animal as droppings. A human will eat the fruit and throw the seeds away. Because so many of them will not find a place to grow, the tree must put out many more seeds than could possibly grow.

Activity: The children can count the number of seeds in one persimmon. Estimate how many fruits are on the tree and get an idea of how many seeds this tree puts out. Of these, maybe 9 or 10 will actually grow.

SIGNS OF FALL TRAIL

Station V

Concepts:

1. Animals must adapt to meet winter conditions.
2. Many animals gather food and store it for winter use.
3. Some animals live together in communities and help each other.
4. Some animals hibernate during the cold months.
5. Some animals go farther south away from the cold.

Notes:

Although we associate an abundance of food with the autumn seasons with its fruits, nuts and harvests, the approach of winter with the cold weather reduces the food supply for most animals. Some animals avoid it simply by migrating south. Some animals such as ants, bees, beavers, and others, live in communities helping each other gather and share food. The bees are a good example of this. They are so interrelated that a single bee could not survive unaided by the other bees. The queen bee lays the eggs; she is a queen because of special food fed her while still a larvae. Drones, the male bees die out before the winter season. The young worker bees care for the eggs and build hives, the older worker bees gather food. During the summer the life span of the worker bee is very short - about two weeks. In the winter, inside the hive, where the bees are not very active, the bees will live several weeks. New bees are born throughout the winter, however, feeding on honey gathered during the summer. Bees will work as long as there are flowers, so some should be found in this area.

Many of the rodents are very active food gatherers- squirrels, chipmunks, white-footed mice, and beavers are ones who gather and store a great deal of food. These animals do

not hibernate during the winter, but they may sleep for a period of time if there is very cold weather. In this part of the country the only animal, other than cold blooded animals (discussed at another station) that hibernate is the woodchuck. Be careful that the children do not get the idea that animals migrate or hibernate in order to escape the cold weather. This is done as an inherited characteristic. No one knows why they do these things, but their ancestors have done this for thousands of years. In true hibernation the body process slows down, breathing is difficult to see. Bears do not hibernate as they may come out on warm days. Some other mammals, ground squirrels, and bats may hibernate.

In order to live during the winter an animal must have food and shelter. This area can provide both. If you could get back into the thicket, you would find "runs" of animals-pathways that they use to travel.

SIGNS OF FALL TRAIL

Station VI

Concepts:

1. The leaves of an evergreen tree are needles. The waxy coating on the needle protects it in the winter.

2. Evergreens do lose their needles, but not all at once.

3. Evergreens may grow some throughout the winter.

Notes:

The seeds of the conifers (the cone is the fruit of the evergreen tree) are not enclosed. They develop on the scales of the cone. The twigs will have buds on them just as a deciduous tree does. Because leaves are the food making organ, evergreen trees can make food through the winter. However, when the ground is frozen, water may not be available for photosynthesis. Activity then slows down or stops. In this area most of our evergreen trees will grow some in the winter. The waxy covering on the needles will keep the water in the needles from freezing.

Activity: Compare the leaves of a broad leaf and an evergreen---shape, feel, and smell.

SIGNS OF FALL TRAIL

Station VII

Concepts:

1. Fall has sights, sounds, and smells that are different.

2. There is more color in fall woods.

3. Change brings about new smells, sounds, and sights.

Notes:

This is an area provided for the groups to study the things around them by using the senses. Some things that can be done here include games (found in box), sitting and just listening, or smelling, or finding colors. The activities here can be used to develop new words-material for creative writing and Huiki and art.

SIGNS OF FALL TRAIL

Station VIII

Concepts:

1. Animals must have shelter from the weather.

2. Cold-blooded animals hibernate.

3. Some animals store their food for the winter.

Notes:

The idea of warm and cold blooded animals may be difficult to explain to children. The feel of an animal will not always tell you if it is warm or cold blooded. A snake that has been in the sun will feel warm to the touch. The difference is the changing of the temperature with its surroundings that makes it a cold-blooded animal. The temperature of a warm-blooded animal is usually the same unless it is sick. Cold-blooded animals in hibernation hardly seem alive. Frogs, toads, and salamanders absorb part of their oxygen through their skin so they do not seem to be breathing. When hibernating in the mud, frogs can live without breathing through their nostrils. Since the life processes have been slowed down, little food is needed.

Shelter can be found in this area-some that was made by the animals themselves; some taken over by other animals. A frog will dig himself into a hole in a bank or soil. A snake may be in a hole under a rock or one made by an animal. Salamanders usually find shelter under rocks. Squirrels and chipmunks will find shelter in hollow trees or in holes left by chipmunks. They will also store their food in these places and often bury nuts and seeds. Since squirrels and chipmunks have bad memories, they often forget where these are buried and the seed will lie dormant until spring and often sprout, so many animals are "farmers" also.

SIGNS OF SPRING TRAIL

Station I

Concepts:

1. Spring changes the dormant plants and animals.

2. A new life cycle begins.

Notes:

The life cycle of most plants and animals begins in the spring. A seed that has been underground all winter responds to the warmer earth and begins to sprout. At first all the food it needs to grow is in the outside shell of the seed, but as the seed sprouts it puts down roots to seek out the moisture and food in the soil. The first signs of spring usually seen are the green buds on the trees and the early flowers. Insects start again, and as the plants begin to sprout insect eggs hatch and there is now food waiting for them. Actually the first signs of spring are not seen by most of us. Most of the first spring happenings are underground where the roots are growing. The dandelions may be the first flower to notice. The Dent-De-Lion, French for teeth of a lion, will have a very quick life cycle of only a few days.

In this area it should be possible to see the first of the insects. Ant hills may be found, and by looking closely at the ground many things can be seen. Many of the grasshoppers you may find are young. They will shed their skins as they grow older and bigger. Any boards or rocks along the way may house some underground insects. (Please replace the rock or board.)

SIGNS OF SPRING TRAIL

Station II

Concepts:

1. Almost all plants have flowers.

2. Food for birds and animals can be found along a fence row.

Notes:

The summac, one of our "pioneer plants" will start early to have leaves. If no leaves are present when you are on the trail, look at the twigs for the buds. Most will have shed the outer covering that protects them in winter. The fruit of these trees that is ripe in the fall is used to make "pink lemonade". Along the fence row can be seen vines and bushes of all types. The blackberry bushes may be in bloom, but usually not until later in the spring, however, the tiny buds can be seen. The cat brier has many tiny points on it and is good shelter for mice and rabbits.

The Bob-White quail uses area like this for its home. If the children are quiet as they walk, they may scare up a covey of quail with the baby birds. Quail, like grasshoppers, prefer the "edge of woods" habitat as shelter. You may hear their "Bob White" even if you don't see them.

Any flowers found along the trail will be marked. Please do not pick any.

SIGNS OF SPRING TRAIL

Station III

Concepts:

1. Many trees have flowers before they have leaves.

2. The evergreen has been green all winter but puts out buds in the spring.

Notes:

The evergreen tree that can be seen has stayed green all winter. (Later on in the trail there will be a chance to see evergreens closer up.) It does lose some of its needles but not all at once as with the broad leaf trees. Look across the tops of the trees in the woods. You may see a slight touch of color. These are the flowers. Most of our trees do not have showey flowers like the dogwood but smaller flowers near the top of the tree that can be pollinated by the wind. The showey flowers are that way in order to attract insects so the pollin can be carried. Those trees that do not need the insects to carry the pollin have smaller flowers, many of which are long-hanging flowers, called catkins. (Oak, hickory, and ash) Look under the oak tree by the shed to see if some catkins are there. The flowers are usually found in the top of the tree because the wind can get to them. The oak tree by the shed may have old acorns under it. Some will have tiny holes in it where a bug, called the snout beetle, has eaten the inside.

SIGNS OF SPRING TRAIL

Station IV

Concepts:

1. Twigs have buds that will open to form leaves and new twigs.

2. Trees can be identified by their bark and twigs.

Notes:

This is a persimmon tree. In the fall the orange fruit will be used by man and animal. Look closely at the twigs. Notice the two bud scales covering the buds. The twigs are usually over-lapping and feel velvety to the touch. Usually there is no terminal bud (at end of twig). Look for the leaf scar where last year's leaf fell off. Most of the flowers are borne on different trees but sometimes they are on the same tree. They develop in the buds, so it is possible that some may be coming out. They are pale yellow and about the size of a bud.

While walking along the trail stop to open some buds if the leaves are not yet out to find the flower inside. Some, like the sassafras, will be on the tree with the leaves; others, like the oak, bloom later in the spring after the leaves have all come out and some will bloom before the leaves. The twigs of the trees are just as different as the leaves.

SIGNS OF SPRING TRAIL

Station V

Concepts:

1. **Animals bear their young in the spring**

2. **Animal homes are everywhere.**

Notes:

Animals need a place to bear their young. Some, like the hibernating grounghog, bear their young in the den. Birds, of course, will build nests. The rodents that might live in this area will make nests in the thicket as well as rabbits. Quail are also to be found in this area. They have both food and shelter in this edge of woods habitat. By looking closely, much can be found in the way of food and material for the animals to make their homes. Some of these homes will be found later on in the trail, but many possible places can be pointed out here. Some of the field birds, such as the meadow lark and the cat bird may be seen in this area. Insect-liking birds may be seen flying high in the air, catching their meals on the wing.

If runways are found in this area, they will be marked as will any nests that are found.

SIGNS OF SPRING TRAIL

Station VI

Concepts:

1. Evergreens change in the spring.

2. Needles are different from broadleaves.

Notes:

The "flowers" of the evergreens are harder to recognize as they so quickly turn into the cones. Many of them will be a yellow color if in bloom. If this yellow is touched, the pollen will come off easily. The children can see the new green needles on the trees and compare them to the oaks and other trees nearby, both in shape, smell, and feel.

SIGNS OF SPRING TRAIL

Station VII

Concepts:

1. There is a change in the spring in color, smell, and touch.

Notes:

Here is an area provided to allow you to have the children try to use their senses. There are some suggestions for games in the box, but you can also just let them try different senses. How many colors? What do you smell? How many shapes do you see? How many sounds do you hear?

Learn to appreciate the woods and all its beauty.

SIGNS OF SPRING TRAIL

Station VIII

Concepts:

1. Animals need shelter in the spring as well as in the summer.

Notes:

On this part of the trail, there are animal homes labeled. Here it is possible for the children to see homes on the ground, under the ground, and in the trees. If a rotten log is nearby, ants can be seen with their eggs. Under stones will be insects and maybe salamanders. Often on the logs will be found fence lizards.

All of the animals and insects have started on their cycle of life and evidence will be found of most of the stages. Food, shelter, and water can be found in this area for many animals. Chipmunks, squirrels, skunks, raccoons, opossoms, some deer, and many birds can find a home here. Most of these animals have to have a shelter as they do most of their hunting for food at night. The only animals you might see here are the chipmunks and squirrels. The others are asleep somewhere waiting for night. Birds will be heard and may be seen in the top canopy of the trees. The small animals will be heard going through the woods. Insects, of course, will be found on the forest floor and on trees. The color and sound of spring in the woods can be found here.

STREAM LIFE TRAIL

Concepts:

1. Streams contain many forms of animal life.

2. Every stream has many different depths and temperatures.

3. Streams vary in size and shapes.

Notes:

A stream may conceal a great many bottom-dwelling animals that are used for food. Fish, raccoons, duck, shore birds, turtles, and frogs hunt the stream for snails, crayfish, and aquatic insects. Streams of all sizes have about the same kinds of botton animals, whether it is a stream small enough to step across or a river as wide as the Cumberland.

A rock with water swirling around it in a clear stream hides dozens of small aquatic animals. Under the rocks may be found crayfish, and perhaps small fish. On its underside flat-bodied mayfly nymphs will be seen sliding over the surface. Slender stonefly nymphs will also be around. Caddis fly larvae, that lives in a coiled tube made of sand grains glued together, will be seen living here.

Gravel bottom usually supports more animal life than any other part of a stream. The sand bottom of a stream, like a sand area on land, often is almost lifeless. Maybe sand shifts about too frequently or, perhaps it provides little food or shelter for freshwater animals. When a clean stream becomes polluted most of the bottom animals die. Mayflies, stoneflies, and caddisflies are the first to disappear. As the stream becomes more polluted, other life in the stream would die out.

Streams, large or small, contain various depths. The temperature will be different at certain depths. Stream temperature is directly related to the amount of sun rays

that reach and penetrate them. Along the top of the stream the temperature will be much warmer than in the middle or bottom area.

Animals and insects live on the tops of streams just as they live on the bottom area. Water striders can be seen gliding across the water in search of food. Water beetles and water bugs can be found living on top of plants and around their stems. Water snails can be seen swimming along the top of the stream. Most water snails are brown but some can be dark green or purple. When they swim across the top of the water their shell hangs down.

The stream is abundant with plants, animals, and insect life. Life in the stream, like that of the forest, is ever changing. Things are born, live, grow to maturity, and die.

COMPASS TRAIL AND GAME

For 4th, 5th, and 6th Grades Only

Concepts:

1. Direction is measured in degrees.

2. Personal measurement can be used to estimate distance.

Notes:

The compass game is designed to help the child learn how to use a compass and to follow a degree reading. By first learning the length of his pace he can learn to do this with direction and degree readings.

The compass course is designed to give more experience in following degree readings in the woods. If desired, some help and materials in mapping can also be done by the group at the center.

A session on using the compass on school site should be scheduled before the group uses the nature center game and trail.

CONSERVATION AND ECOLOGY TRAIL

Station I

Concepts:

1. Soil is the primary source of our food, clothing, and shelter.

2. Soil, plants, and animals are interdependent.

3. Wind and water erosion are the major factors in destroying soil.

4. Soil conservation is a very serious problem.

Notes:

The area here has been eroded into gullies. The roadside bank and the steep slope has allowed the water to run unchecked down the bank. The steeper the slope, the more power the water has to carry soil away. The "clay" color of the bank shows that the top soil has been washed away, and the lower layers of the soil are showing. Usually, the bank will be hard packed. Since seeds sprouting must send roots into the soil, a hard packed surface is difficult for the roots to penetrate.

When drops of water fall upon bare earth the force of the impact of the drops acts like many tiny hammers pulverizing the earth. This loosened soil is washed away rapidly by the rain. The splash board in this area shows how high a rain drop will splash. A ground covering of green plants provide many leaves that act like tiny umbrellas to cushion the force of the falling drops and allows them to roll or fall lightly from the leaf to the ground.

Some soils are course and porous and allow the rain to seep readily below the surface to become underground water. Top soil is loose and is often washed away. Roots of plants help to hold the soil together. When there is an area without plant life there is nothing to hold the top soil. The clay soil that is not washed away becomes so

tightly packed that few plants can grow. Rain rolls off instead of seeping into the ground. This is shown to the children by the use of two cans, timing the period of time it takes for water to seep into the ground in a bare place and a planted spot.

By planting trees close to the bank much can be done to stop the erosion. Check dams in the gullies will also help to stop or slow down the flow of water so that plants may grow. This is a good project for a school site where there are erosion problems.

CONSERVATION AND ECOLOGY TRAIL

Station II

Concepts:

1. Every living creature is affected by other creatures around it and by his environment.

2. Each type of living condition is a plant animal community.

3. These communities differ because of climate, plants and the type of soil that is in these communities.

Notes:

This area is known as the "edge of woods" community. This field was once used by man. There is evidence in planted fruit trees, cleared areas, and the fact that it was cleared for farming. The "pioneer plants" in the form of sassafras and sumac are growing and evergreens are beginning. This type of area will take care of certain wildlife. By looking at the possible food supply and the shelter available it would be assumed that small rodents, rabbits, and seed and insect feeding birds may live here. By introducing the "pyramid of food" here this concept can be carried on into the different forest community.

Another important concept in Ecology is that of adaption. Plants and animals gradually develop traits that will suit them to their specific environments. When this area was cleared by man, the animal and plants within it had to adapt to survive. Food is the strongest thread which holds the web of life in balance. The green plant is the basis of all food. In a study of this community it can be seen that the plants found here are those that require a lot of sunlight; therefore, the birds and animals here will be those liking this type of food.

A difference will be seen in the forest community. When these plants are making food they release oxygen into

their lungs and breathe out carbon dioxide. This is the carbon cycle and another way plants and animals affect each other. The pyramid of food (see sign at this station) can be figured from the plants and animals found in any community. A food pyramid that might be found in this edge of the forest area might be:

owls, hawks, foxes, raccoons, oppossoms,
snakes, rabbits, rodents,
insect eating insects,
insects, plant eating insects,
green plants, decaying plants

In the forest we will find a slightly different pyramid and in each community in the world different food pyramids will be found. If one layer of the pyramid is destroyed, animals above it will be destroyed also. This is one reason predators in a natural community are so important to the balance of that area. Man by killing hawks, owls, and snakes, has allowed the mice and rats to multiply and become a serious threat to both crops and health. In this "web of life" a broken strand can become a problem for both man and animal.

CONSERVATION AND ECOLOGY TRAIL

Station III

Concepts:

1. As the environment changes, so do the plants and animals living there.

2. All natural communities have three types of inhabitants: producers, consumers, and decomposers.

3. Nature will maintain a balance of life if it is left alone.

Notes:

As in all natural communities the type of animal and plant that lives there will depend on the physical features of the environment. Emphasis should be placed on the food being eaten by the different types of animals. Shelter for the animals will be different. There will be more trees for birds and squirrels. Those animals that like a moist place will be found here and in the deep forest community. Because this is a fringe area, many animals that prey on the field animals will use it as shelter. Foxes, hawks, owls, and raccoons will live here and feed in the open area. Plants here are starting to change. They like more shade and moisture. Some cannot stand the shade and will die out. The three inhabitants of any area will change with the area. The predators will seek out the plant eaters. The plant eaters will look for seeds and plants to their liking. A new type of insect, those that eat dead matter instead of seeds (ie. the grasshopper would be found in the open field, as would a bee) are the important decomposers. Therefore, the producers are the plants, the consumers; the plant eating animals; and those that feed on them; and the dependent plants and insects, the decomposers that turn the decayed matter back into soil.

Man, by cleaning woods of dead trees, by cutting so there are no trees left in an area, by killing off certain animals or birds will destroy a link in the chain of life and cause the entire balance to be disturbed. Only by learning the importance of each strand of the web of nature can man learn to use the fields and forests wisely.

CONSERVATION AND ECOLOGY TRAIL

Station IV

Concepts:

1. Fire destroys more than the trees.

2. Man is most responsible for forest fires.

Notes:

Fire in a forest destroys more than lumber. It also destroys the food, cover and shelter for the birds and animals living there. These animals must then move away or die. In addition the soil protection is gone, and heavy rains may wash ashes and silt into a stream or river. This may make the river unfit for fish. With the plant cover gone on the water shed, the stream may flood during wet seasons and it may dry up or get too low and warm for fish during dry seasons. The floods may destroy property downstream and carry soil from, not only the forest floor, but any farms it might flood along the way.

Although fire is not the first enemy of the forest (insects pests and plant diseases are first), it can usually be traced to man's carelessness. This is one place where the individual makes his action felt towards preserving a natural resource. Since forest fires are usually set by individuals, any person who makes certain that his actions and behavior does not result in forest fires is making a definite contribution.

CONSERVATION AND ECOLOGY TRAIL

Station V

Concepts:

1. Man, by not understanding the ecology of an area, can destroy it.

2. A knowledge of basic facts of good conservation pratices can be useful-on the farm, in the woods, on a school site, or yard of a house.

Notes:

It has long been man's practice to do things the easy way, without regard for a right way or a wrong way. The early pioneers used a farm and when the ground could no longer support them they moved on. Today this cannot be done, and yet in many parts of the country, there is land that was once fertile and that could support crops or families that live on it. Farmers kill hawks and then complain that the rats are eating all of the grain. They cut out entire forests and floods carry off all of their topsoil. In order to work with nature and expect something in return, man must learn the rules of interdependence and subscribe to them.

The area here is an example of "man" wanting something in a hurry. A trail was supposed to be cut; a group cut it the easy way and without something being done, the trail will become a gully, and water needed by trees and plants will run down and flood the small wet weather stream at the bottom.

The new trail, cut on the "contour" (the lay of the land), allows for the water to seep into the ground. Check dams will be placed on the old trail to retard the flow of water and hopefully allow plants to grow back. Contour planting on farms is a result of finding out-the hard way-about soil and water loss. Rotation of crops has taught us that we can renew soil but only by learning about Ecology.

CONSERVATION AND ECOLOGY TRAIL

Station VI

Concepts:

1. A plant or animal is a product of their environment.

2. A "Niche" is the place or role of an animal or plant in its community.

Notes:

This area is the so-called Climax community of the forest. Here the life is abundant and varied. By spreading out a sample of the forest floor, called litter, you will find many living organisms. Some of these are microscopic in size (bacteria and fungi), but many tiny animals are visible to the naked eye such as mites, insects, and millipedes. Each year about two tons of debris consisting of dead leaves, flower parts, fruits, twigs, logs, excrement, and animal remains fall on each acre of forest. This debris is decomposed by the living organisms, and forms the humus to make new soil. This will also help to retard water running away. The foliage of the trees and the litter on the ground help prevent evaporation of the ground moisture. The plants and animals in this area are those who like the shade and more moisture.

Pick up some dirt and see if the forest floor is damp. This is the dominant state of the plant succe sion. Little will change this now unless a disease or fi. gets started.

The pioneers, by clearing land for farms, forced the animals into the woods. Today there is less and less land for wild plants and animals. This is the main reason we do not find bears around middle Tennessee. They must have a great deal of land in order to find food, and there is no large park that can take care of them.

Each animal and plant is helpful to man in some way. By taking all of their shelter and food area, we not only destroy them but a way of life , and many times create problems for ourselves to which there are few solutions.

CONSERVATION AND ECOLOGY TRAIL

Station VII

Concepts:

1. All man should accept stewardship of the natural resources.

2. Everyone, no matter how young, can help in some way.

3. The aesthetic values of good conservation are just as important as those measured in dollars and cents.

Notes:

It is quite likely that all life, even our own, depends on an ecological balance, so delicate, and for the most part unknown, that it sometimes takes generations to learn the results of our mistakes in resource use. The aesthetic values cannot be measured. Often they cannot be taught, but appreciation and interest in our environment can often come through an understanding and awareness of life around them. By seeing color, by hearing the call of a bird or the wind through the trees, by smelling the fresh ground after a rain, or feeling the softness of a fern, man can begin to feel the vastness of the universe and the importance of each tiny thing in it, not only to itself but to each other.

Peace at heart and a fullness of belief in living our lives to the fullest can often come as a result of a walk in the woods. At this station take time to enjoy--feel, see, smell, and believe.

FORESTRY TRAIL

Station I

Concepts:

1. Many trees are found in the forest community.

2. Trees serve man and wildlife in many different ways.

Notes:

The trees and shrubs found in this area are called the pioneer plants of the forest. They require a great deal of light and water for their development and are found in the initial stage of forest development. The sumacs, sassafras, persimmon, and tulip poplar trees are found in this area.

The sumacs (pronounced "shoe-mack") have compound leaves, which are green above and silvery beneath. In the early fall they have many clusters of rusty-red fruit cones, which seem to stand upright on their stem. Their tart little berries are relished by many kinds of birds and can be used to make "Indian lemonade" or chewed to satisfy your thirst on a long hike.

There are several different species in the sumac family, mostly found in warm or tropical regions. One of them is poison ivy. Although poison ivy has the characteristics and habit of a vine, it is not an ivy. Poison ivy has gray-white or ivory fruit instead of red and has three leaves. "Leaves three, leave them be" is an important phrase to remember while at this station and on any walk through the woods. Poison sumac is another member of the sumac family. This large shrub or small tree will be found only in wet areas.

Our state tree is also found at this station; it is the tulip tree. In pioneer days it was called the "canoe tree" and used for their dugout canoes, or to help float rafts of heavy oak and walnut logs, because its wood is very light and very soft. In the winter, the buds of the tulip tree are

reddish, flattened, and "duck-billed". The leaves, four to six inches long and wide, turn bright yellow in the autumn and have four pointed lobes as a rule. The large tulip, like flowers, have three drooping sepals and six erect creamy petals with an orange base.

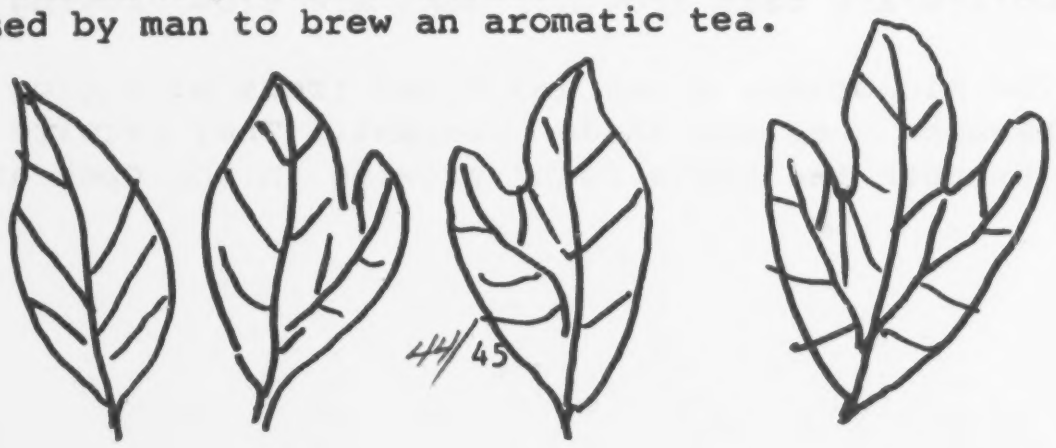
The yellow poplar or tulip poplar, as it is known in the lumber trade, has many uses.

Poison sumac has compound leaves, with leaflets in opposite pairs. Its first pods are grayish in color.

The persimmon tree is also found in this area. This tree has a thick dark brown or dark gray bark, which is deeply divided into small square plates. The wood of the persimmon tree, though it quickly rots underground, is so dense, hard, heavy, and strong that it is preferred for mallets, shoe lasts, head of golf clubs, the butts of billiard cues, and the shuttles used in textile weaving.

The fruit is round with four broad brown woody bracts at the base where it is attached to the twig by a short thick stem. As the fruit ripens, it turns from green to orange with a purplish tint and finally to an orange-red. The yellowish-brown flesh encloses several large flattened seeds, brown and hard, which Indians used to grind with meal, and which pioneers roasted as a substitute for coffee. The persimmon is a favorite fruit of animals as well as man, if eaten when fully ripe. If the fruit is eaten before becoming fully ripe, a substance known as tannin will pucker up the lips, gums, and tongue.

The sassafras tree, with its thick, red-brown, and deeply furrowed trunk bark, is also found in this area. It is one of the few trees having three different leaves on the same tree, or even the same twig. Some are oval; others have one lobe; others have three large lobes. There is an oblong, dark blue or black berry and is eaten by many birds. Sassafras wood is soft, light, brittle, and weak, but very durable in soil and is used extensively for fence posts and bean poles on farms. The roots of the sassafras are used by man to brew an aromatic tea.



FORESTRY TRAIL

Station II

Concepts:

1. Trees can tell many things.

Notes:

Trees stand tall and silent, anchored by their long expanding roots. The hackberry, oak, hickory, and other trees will be found inhabiting this area. Though they are silent, many things can be learned from them. Trees keep their own record of climatic changes or events that affect their growth. Each year a ring is added, which records whether it was a good or bad year for its growth. When conditions are ideal the rings will be large; small when the conditions for growth were bad. When a tree is cut one can see these rings of growth, which are called annual rings or tree rings. Two rings equal one year of growth.

When we examine the stumps found at this station we will see in the center a dark dense wood. This is called the heartwood, with annual rings which are very narrow near the core because it grew very slow when young in the shade of other trees. Surrounding the heartwood is a lighter color wood known as sapwood. Beyond this and just inside the rough outer bark is a spongy layer of inner bark called phloem.

In any tree the thickness of the rings are affected by many factors: (a) the precipitation of rain or snow; (b) the amount of sunlight it gets; (c) the fertility of the soil and whether it is aerated or badly comported; (d) temperature; (e) the length of the growing season; (f) fires; (g) insects. Although some trees grow faster than others, they all hold a wealth of information. Sycamore and poplars are fast growing; oaks are slow growing.

The hickories, oaks, and other trees will grow in this area because they are shade tolerant. They require less sunlight than the trees found growing in the open area.

FORESTRY TRAIL

Station III

Concepts:

1. Specific trees will be found growing in certain areas of the forest.

2. Animals make use of trees for homes and food.

Notes:

We are now in the climax forest. Here will be found the beech, oak, maples, and hickory trees. These trees will grow with little sunlight although moisture is a requirement of good growth.

The beech tree, a very dominant and noticeable member of our climax forest will be found at this station. The trunk is tall and column-like with thin smooth gray bark, sometimes mattled with dark spots. The roots are huge and seem to spread in all directions searching for a secure foot hold for its massive trunk. There are many twigs and the foliage is dense. The fruit is a prickly burr which opens to drop two shiny brown three-sided nuts. These are sweet and edible. The heartwood is reddish, tough, and strong, but hard to season and not durable in the ground. It is used for furniture veneer, tool handles, and creosoted railroad ties, but principally for fuel. It ranks with birch, hard maple, and apple for fireplace wood.

Below its massive roots animals may make their home. A chipmunk may be seen scurring back and forth securing food; a snake may use it for a hiding place, and birds may be seen perched high among its branches. Ferns and other shade-tolerant plants will be found in this area.

FORESTRY TRAIL

Station IV

Concepts:

1. Disease, fire, and man can be harmful to the forest.

2. The life span of trees in the forest may be very long.

Notes:

Disease, fire, and man can be very harmful to the forest community. At this station the large beech trees which should have been harvested long ago have been left standing. Over a period of many years it has become subjected to a disease known as heart rot. Eventually this tree will die and become a member of the forest floor. Many animals that inhabit this area will use the fallen tree for home, shelter, and food.

Fire, one of the most dreaded enemies of the forest community, can be caused by man and through natural forces-lightning. When lightning strikes a tree the sapwood is heated to a boiling temperature. The tree may splinter or catch fire. The beech tree, because of the fatty content of the wood, their smooth bark, and their many fine twigs and buds, are good conductors of electricity. Therefore, a bolt of lightning is usually carried down into the ground harmlessly.

Trees in the climax forest may live to be very old. The beech may attain the age of 300 years. Most of the trees in the climax forest are deciduous and shed their leaves annually. These leaves provide the forest floor with a new cover. Here they decay and return to the soil. During this process they provide food and shelter for some insects.

FORESTRY TRAIL

Station V

Concepts:

1. Hollow trees serve many purposes.

Notes:

This beech tree has become hollow, maybe from several sources. Heart rot may have been a cause as well as fire. From its burned appearance, one would suspect fire. This could have been caused by a lightning strike or by man. Man is the most logical explanation. He could have been a hunter trying to smoke out a raccoon, opossum, or squirrel which inhabit hollow trees. Because of these factors, this tree will eventually die but until then it will serve as a home for many animals, insects, and birds. Fungus will invade and use the tree also.

The beech tree here will continue to live even with most of its heartwood displaced. There is enough room for the sap to flow between the cambium and sapwood areas.

FORESTRY TRAIL

Station VI

Concepts:

1. Trees have distinguishing characteristics.

Notes:

Most trees can be identified by the bark, buds, twigs, or leaves. In this area one will find many different trees. Shagbark, hickory, oak, maple, and others can be identified.

In the spring and autumn one can use the leaves of trees for the purpose of identification. Most trees have distinctly different leaves. Some of your oak leaves will be similar, but a close look will reveal some characteristic that is different. In the winter, and because these are deciduous trees, the leaves will fall off. If you examine a twig, you will find a bud at the tip. Along the side of the twig are leaf scars, marking the stalk of the leaf dropped off in autumn. Above the leaf scar are axillary buds. These buds contain young leaves and flowers which will open up in the spring. One can examine these twigs as a means of identification and to see what leaves or flowers will come out in the fall.

The bark of a tree can also be used as a means of identification. Use the accompanying bark and twig key to help identify trees when no leaves are present.

FORESTRY TRAIL

Station VII

Concepts:

1. Forests must be harvested.

Notes:

Many things are made of wood. Your desk, pencil, paper of all kinds, radio, and T.V. cabinets; wood is everywhere. This wood comes from the forest. Trees must be grown and harvested before these things can be made. A tree crop does not have to be cultivated because the forest will seed itself. However, they must be protected. Fire and the grazing of animals must be controlled; crooked and diseased trees must be cut and removed in order that the healthier trees may have room and nourishment to grow. Cutting poorer trees from the forest is called selective cutting.

Loggers or foresters measure trees for selective cutting. The trees are measured to see how much lumber they contain. Trees have a measure of their own--board feet. A board foot is a way of measuring timber and lumber. One board foot is a piece of wood one foot long, by one foot wide, and one inch thick.

GEOLOGY TRAIL

Station I

1. Rocks are the natural solid material that makes up the earth's crust.

2. Rocks are formed in three ways.

Notes:

Rocks constitute the earth itself. They are the materials from which soil is made. Rocks fall into three great categories: igneous rocks, sedimentary rocks, and metamorphic rocks. Some of the common kinds of rocks belonging to these three groupings are: granite, basalt, pumice--sand, clay, gravel, sandstone, shale, conglomerate, limestone--schist, geniss, marble, and slate.

Igneous rocks were once a hot and fluid mixture, termed by geologists as magna. As this hot mixture of magna cools slowly, the minerals will form crystals. The slower the cooling, the larger the crystals formed. Granite is an example of igneous rock cooled slowly within the earth. Felsite composed of tiny crystals cooled more rapidly either within the earth or as a lava that flowed from a volcano.

Sedimentary rocks are composed of weathered fragments or sediments of igneous rocks. They may be loose, as clay, sand, gravel, or may be firm and compact when these fragments are compressed by weight or overlying deposits and mixed with cementing minerals such as lime, silver, and iron. Shale, sandstone, and conglomer (sand and gravel cemented together) are compact forms of clay and sand. Limestone is a sedimentary rock made of crushed shells and sea animals cemented together.

Metamorphic rocks are rocks that have become altered by subjection to tremendous pressures and heat. These are rocks that have been changed from their original form to a new form. They are much harder and crystaline than sedimentary rocks. They are not gritty to the teeth as sandstones are (weathered specimens). Common types of metamorphic rocks are slate, quartize, and marble.

At this station will be seen examples of chert. The common name for this chert is flint. Some chert is brown, yellow, or white. Chert has many uses but the most common is its use in highway and road construction.

GEOLOGY TRAIL

Station II

Concepts:

1. All rocks and minerals will not be found in the same locality.

Notes:

Rocks, mostly which are composed of minerals, are developed under different circumstances. They will be found in an area where conditions assist their formation. At our nature center the primary rock formation is chert, and there may be some limestone present. The rocks along this wall were placed here. They are natural, some of them, to Tennessee.

Rocks can be identified many ways. Color, hardness, and streaks are methods used by geologists in rock identification. Certain rocks have a particular color. Chert in its natural state, is gray. Some minerals may be pink, black, rust, or some other color. Streak is the color a mineral makes when it is rubbed against the back of a tile or some other piece of unglazed "porcelain". The color often is very different from the color of the entire specimen. Some blackish minerals, for example, make dark red streaks, and some green, purple, and blue minerals make white streaks.

Hardness is something we cannot feel. The only way to measure it is to find out what minerals scratch other things or can be scratched by them. The softest mineral can be scratched by your fingernail; its hardness is 1. The hardest mineral, which is diamond, scratches all the others; its hardness is said to be 10.

GEOLOGY TRAIL

Station III

Concepts:

1. Rocks are affected and changed by natural forces.

Notes:

Solid rock is continuously being subjected to change. The freezing and thawing of water; pressure from growing roots; moving ice, water, and wind; and chemical reactions with rock minerals help break up rocks. This eroding process is called weathering. It greatly alters the appearance of rock, softens it, and changes its texture.

In weathering, hot sun causes a rock to expand, and cold weather causes it to contract. The result is that the rock begins to crack. Water seeps into these cracks and when it freezes, the cracks are expanded because of the expanding ice.

Wind, too, is a great weathering force. It can pick up the finer particles of rock and carry them long distances. It can also hurl them against rock surfaces with such force it causes them to chip.

Air also affects rocks. The chemical composition of minerals in some rock will react with air. At this station we see an example of this. The rock at this station is chert. Its natural color is gray, but due to its exposure to air, the color has been changed. There are two distinct colors now; one is gray, natural color, and a light tanish color. This is a result of a process called oxidation. The mineral Iron Oxide in the rock has changed when it was exposed to the moisture in the air. Rust is also formed in the same way on exposed iron.

GEOLOGY TRAIL

Station IV

Concepts:

1. Rocks tell a story of the earth's formation.

2. Fossils are found in rocks.

Notes:

The rock wall at this station may be many years in age. The rock is the same type found in this area, chert. One layer of rock is on top of the other. We call these layers stratus. Between these layers will be found a dirt surface which is called the bedding plane. The layers of this rock wall formed when sediments were deposited here. This area was once under water, and the animal, vegetable, and plant life died and was deposited. The layers of sediment are converted into rock either by pressure or by being cemented together by other minerals. At the top of this wall one can see the layers of soil which supports animal and plant life. The older rock layers are usually at the bottom of the wall with the younger layers on top.

Fossils are found mostly in sedimentary rock formations, and therefore, may be found in this area. The word fossils means something dug out of the earth. For our purpose it means the remains of living things which are preserved in rocks. A fossil can take many forms. It may be animal or plant found intact. This is rare, or only part of an organism is preserved. To become a fossil, a plant or animal must usually have hard parts. It must be buried quickly to prevent decay and must not be disturbed throughout its long period of fossilization.

GEOLOGY TRAIL

Station V

Concepts:

1. Water changes the earth's surface.

2. Water affects rocks.

Notes:

Water is a powerful yet essential force; without it, all life would disappear from the earth's surface. Water will break down solid rock, will dissolve soil, and will change the shape of the land. At this station one can see the effects of running water. Along this stream bed, the rocks found in the water will have a different surface than those found on land. The rocks in the water will have a smoother surface, due to the wearing of the rock by water continuously passing over them. Along the banks of this stream one can see how the water has cut deep depressions in the rock formation. These deep depressions are further subjected to wind and ice.

Very little plant life will be found in this stream because the sand, gravel, and rocks deposited here will not support adequate plant life. As the years pass, this stream may widen and even deepen causing further erosion.

GEOLOGY TRAIL

Station VI

Concepts:

1. Some rocks are formed from animal and plant life.

Notes:

Animals and plants that live in the water eventually die and sink to the bottom. If they are not eaten on the way down, they come to rest on the sea or lake bed. On the lake bed their bodies are ground against rocks and decay into a powder which gradually hardens. This is the manner in which limestone is made. Limestone is composed chiefly of shells and coral.

Some limestone deposits can be found at this station. Most of the limestone has been washed away by the water flowing in this area. Limestone can be identified by its reaction to an acid. If one will put a few drops of a weak acid on limestone, a fizzing, hissing sound and bubbling appearance will be noted. Effervescence is the name given to this bubbling and fizzing.

GEOLOGY TRAIL

Station VII and VIII

Concepts:

1. Soil is an essential ingredient for life.

2. Soils vary in their composition.

Notes:

Rocks, weathered and broken down by air, sunlight, and water, produce soil materials. Appearing then are the fungi, lichens, mosses, herbaceous plants; and the woody plants such as trees; also animals, and finally man. Land plants could not grow; plant-eating animals could not live; and the meat-eating animals would perish, without the minerals in the soil.

Soil is more than weathered and decomposed rock. It is very complex, and there are many types depending upon difference in climate, type rocks, vegetation, and age. In general, soil lies in layers called horizons. The upper layer, or top soil, is the "A" horizon. In the forest it is covered with humus--decayed and decaying remains of plants and animals. The top soil, which may vary from a few inches to several feet deep, merges with the mineral subsoil, the "B" horizon--clay or muck. This layer contains materials needed by plants for their growth and development. Beneath the "B" horizon is the "C" horizon, or parent material, such as rock weathered by exposure ages ago but still unchanged by the soil-building process.

Soil is not a dead substance; it is teaming with life. Bacteria, minute plant and animal life, fungi, molds, insects, centipedes and millipedes, worms, and burrowing mammals live in the soil. The soil found in the area took thousands of years to develop. It contains various minerals and can be tested for many different things. Soils contain acids and can be tested for this; some are basic. Some soils are richer than others and some contain larger gravel particles. The difference in soils can be seen by comparing the soil found at Station VII with that at Station VIII.

The soil at Station VIII is more clay than anything else. The top soil or humus layer has been removed by a process known as erosion. If tested, it will give a distinctively different content reading. It will be found to contain more and larger gravel than the soil at Station VII. When traveling from Station VII to Station VIII, notice the effects of erosion. Soil is being washed away and gullies are being formed by the water washing down this slope.

PLANT TRAIL

Station I

Concepts:

1. All plants do not grow in the same area.

2. Plants need water, soil, and sunlight in order to grow.

Notes:

Plants are living things. They grow from seed to maturity, reach old age, and finally die. They take water and nutrients from the soil, combine it with the sun's rays, and manufacture food in their leaves. Plants live in communities and compete for survival and growing room. They have certain requirements for life and by knowing some of these requirements, we can determine where they grow best and how to manage them. Plants that must have direct sunlight to survive are called shade intolerant. Plants that can survive in the shade are called shade tolerant plants. If a plant does not receive enough light, it will not be able to manufacture food and will die. Many branches of trees die because the leaves are too shaded. The in-tolerant plants reach for the sunlight. As they grow, the soil beneath becomes shaded and rich with decayed organic matter, making it possible for tolerant plants to grow. Only the tolerant plants can reproduce in the shade and when the intolerant plants die the tolerant plants are ready to take their place in the community. The changing of plants in a community is part of the ecological plant succession. Many times fire, insects, disease, and man interrupt the plant succession. These are natural influences that can be beneficial or harmful.

The plant trail is designed to help the children see the affect the environment has on plants as well as wild-life and other factors. In this area can be found examples of the field plants, the "pioneer plants", and the beginnings of the tolerant plants. Each area can be compared as to the

type of plants in each. The plants in the field are annuals, perennials, and biennials. The annual plants have a normal life of less than one year. They germinate from the seed, regardless of the weather or growing conditions. Some winter annuals in this area germinate from seeds in the late summer or fall and store nourishment to carry through the winter. At the other extreme are long lived plants that go on growing and maturing seeds year after year somewhat indefinitely. These are usually woody plants (trees and shrubs). The percentage of annuals and perennials are about the same. A much smaller number of plants, percentage wise, are biennials. These plants grow the vegetation the first year, storing food in enlarged roots and stems. The second growing season is given to the production of flowers, fruit, and seeds. When the seed crop is matured, the store of nutrients is exhausted and the plant dies.

As "weeds" change so quickly it is not necessary for the children to learn names although some will be identified for them. The important concept is that the plants will be different in different living communities.

PLANT TRAIL

Station II

Concepts:

1. Plants need different living conditions in order to grow.

2. Each part of the plant has an important part to play in its growth.

Notes:

All living things, either plants or animals, have the following characteristics: they need food; they breathe; they grow; they reproduce themselves; and they adapt themselves. Living things compete in a struggle for existence. Their survival depends upon their ability to adapt to their environment. The environment of habitat of living things is composed of many segments: extremes of temperature, amount of moisture, intensity of sunlight, topography, soil conditions, elevations, and kinds of surrounding plants and animals. In their struggle to survive, living things have adapted themselves in many ways to their environment. They adapt themselves to climate through the shape and size of leaves to reduce evaporation, as in the evergreens; extensive root system; elaborate storage systems; and becoming dormant and losing leaves in winter.

A seed plant has four organs: root, stem, leaves, and flowers. Each of these organs has a function to perform. The principal function of the roots is absorption; of the stems, transportation; of the leaves, food manufacture; and of the flowers, reproduction. These organs perform other functions in different plants, such as roots: anchorage and storage; stem, support and storage; and leaves, respiration and transpiration.

Green plants manufacture food in the presence of sunlight by combining carbon dioxide from the air and dissolved minerals from the soil. The food, manufactured chiefly in the leaves, is the green coloring material called chlorophyll. This process is called photosynthesis. This food is then stored mainly in the stems and roots.

By checking the thermometers in this area, the children can see the difference that extremes make. The parts of the plants, both the small ones and the leaves of the trees, can be examined for their function. Dependent plants and non-seed bearing plants will be discussed at a station on down the trail.

PLANT TRAIL

Station III

Concepts:

1. There are many things in the forest that affect plants.

2. All things in a natural community are dependent on everything else.

Notes:

No natural community is a static one. Many factors and conditions will influence the area and the plants and animals living there. Insects will bore into the wood, lay eggs inside the bark and strangle the tree, eat leaves and some seeds. Disease, as in this beech, causes wood to rot and decay. The wind blows tops out of trees, causing disease and insects to enter the tree. The wind also helps to disperse seeds. Fire will burn trees and other plants, allowing some seeds to germinate. The animals will chew the bark, eat young trees, transport seeds, and eath other animals that harm trees. Man will mark trees with knives, throw trash into the woods, and is careless with fire, but can also protect and manage trees.

The plants here in the forest depend on all of the elements, both in a helpful manner and in a harmful one. The soil anchors the plants and supplies them with water and minerals. The minerals in the soil, its acid and alkality, affect what plants will grow. Water affects the plants, both in the transpiration and in the type of plant grown. Wildlife not only helps to carry seeds but gives of CO^2 which the plants need. Man, of course, can help by growing crops and helping the natural community by correct management.

PLANT TRAIL

Station IV

Concepts:

1. All plants do not make their own food.

2. Some green plants do not bear seeds.

Notes:

Plants that are not green do not make their own food and must depend on other green plants. These are the molds, yeasts, bacteria, and other fungi. The parasites take food from plants that have made it. Some of these plants use the food from dead plants. Some plants cooperate together to get food. Lichens are a union of algae and fungi and exist by a process called symbiosis. A few plants will manufacture their own food but rob moisture and minerals from living plants. The best known of this type of plant is the mistletoe.

Plants may be grouped according to the method of reproduction. The plants that reproduce by spores include the bacteria; algae; slime molds; fungi, including mushrooms, mildews; molds, lichens, and rusts; and mosses, including liverworts and ferns. Most of these can be seen in this area. Use the mirrors to look at the under side of the plants rather than picking them.

The lichens, on both the trees and the rocks are interesting because of the union. The algae provides the green food and fungi provides the ability to "stick" to a home and to soak up moisture. In the fall and winter, the food part of the union is not working so the lichens will appear gray, but in the spring it takes on a green color. This plant is one that will grow on bare rock. If there is life on other planets, most scientists feel it will be a form of lichens. It provides food for animals and some is used by man. On the Tundra, lichen is eaten by reindeer.

Spores differ from seeds in that they do not have stored food to start the plant growing. They are produced in great number and depend on the wind to carry them to a suitable environment. Most spores die.

PLANT TRAIL

Station V

Concepts:

1. The final stage in a plant community is called the climax.

2. Climax communities will remain the same unless disturbed by man, fire, or disease.

Notes:

A climax community usually takes its name from the dormant trees. In Tennessee our climax community is a beech, oak, hickory, or maple forest. Here can be seen the difference in plants from the pioneer, field, and edge of forest plants seen at Station I and II.

Mature plants grow at different height levels in the natural community. In the upper level will be found trees; in the middle level shrubs, bushes, and small trees; and in the lower level flowers, ferns, mosses, mushrooms, lichens, and molds. Each level supports its own life. There are some birds that will live only in the canopy or upper level. Other birds and animals will live in the middle level, as chipmunks and squirrels; and on the ground level live insects and those who use them for food.

As the animals and plants die, the decomposers turn the organic matter into soil. Because of the root system of the trees and plants and the organic humus, the climax forest floor will hold moisture more readily than that in the open field. The sunlight does not cause evaporation as quickly, and so plants that like more moisture will grow here. Mosses, ferns, and fungi, along with some wild flowers will be found here but may never be found in other environments.

This forest land readily absorbs water and provides ground cover which will keep soil erosion to a minimum. In a forest community such as this, man can help by thinning out some trees so that others can grow. This is done on

timber land. Not only man, but the natural community profits from it. Cutting down all of the trees, however, will result in loss of soil, wildlife, and the ground plants. Man must be careful in reshaping his environment so that he will not upset the balance in life communities to his own long-range detriment.

PLANT TRAIL

Station VI

Concepts:

1. Some plants use more moisture than others.

2. Some plants can grow on rocks in the water.

Notes:

Here along the edge of this wet weather stream we may find some plants not found in either the field, edge or forest or climax community. Algae is the name of the plants that will be found growing on the rocks in the stream. Usually we think of algae as the green scum or slime but sometimes it is yellow or brownish-green. The algae will only grow where the water is sluggish, but some rocks at the bottom of a swift stream may have some forms on it. It will be very green in the spring and summer when it needs to make food and then not as green in the winter when it is dormant. It takes a great deal of water. There is a spring in the bank and some algae can be seen on rocks directly under the spring. This is a "wet weather" stream but usually has a little water in it.

Water cress may be growing where the water is deeper. Many people eat it in salads, but the water it grows in should be pure before using it for food.

In the spring some of the plants that can be seen coming out very early along the stream might be the skunk cabbage. Its smell is bad but actually the root, which is very heavy and about a foot below the ground, is good to eat and was used by the Indians.

Along the banks can usually be seen the blue flag, a close relative to the Iris. It is usually seen early in the spring. The Jewel weed grows in the fall and if the leaves are put under the water, they look like silver. The flower is used for bee stings, and the Indians made other medicines from it.

The edge of the banks will have more moss and more of the shade-loving plants will grow near the brook. Water from rains will flow into this stream, but it hardly ever becomes a flood as the roots of the tall trees around it hold the soil and allow the water to soak into the ground rather than run off.

PLANT TRAIL

Station VII

Concepts:

1. Plants are pollinated in many ways.

2. Seeds are transported in many ways.

3. Animals depend on plants for shelter and food.

Notes:

In the edge of woods natural community much can be seen in the interdependence of everything in nature to one another. Plants in this area can provide shelter for many small animals, who in turn provide food for the predators. The thicket, vines, and bushes provide food for all of the plant eaters, including birds, deer, mice, rabbits, and some for foxes, raccoon, and skunk. Deep in the thicket are rabbit and mice homes, as well as nesting places for birds. These plants are different from those seen in the climax forest and somewhat different from the field community although the pioneer plants are present here also. Notice that the trees are either evergreens, sassafras, or sumac, all trees that like sunlight.

The plants in this area can be pollinated in several ways. It is necessary for pollen from a flower to fall on the egg cell of a flower in order to produce seeds. In self pollination, the flower fertilizes itself; this flower will be unattractive with little scent. In cross pollination, the wind can carry the pollen, or pollen is carried by insects. These flowers will be brightly colored and have a pleasant odor to attract the insects.

The seeds can be transported by birds and other animals spreading them in droppings; wind carrying seeds; cones, acorns, etc. rolling downhill; pods breaking open with explosive force, and seeds with hooks or claws to catch onto fur or animals. Some of most of these types can be seen in season in this area.